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ABSTRACT

This paper details the considerations involved in determining suitable video projection systems for displaying the Apple Macintosh's screen to large groups of people, both in classrooms with approximately 25 people, and in lecture halls with approximately 250. To project the Mac screen to groups in lecture halls, the Electrohome EDP-57 video projector was chosen. For a classroom of approximately 25 people, Electrohome EVM2319 black-and-white monitors that had been modified at the factory to accept 22.355 KHZ were used. A description of set-up procedures at Drexel University is provided. Also provided are performance data and specifications for the EDP-57 projector and monitor; and space requirements for differing situations, i.e., diagonal screen for standing audience with floor stand or ceiling mount, and rear projection and vertical mount requirements. (THC)

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Video-Out Projection and Lecture Hall Set-Up

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**Video-Out Projection
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January, 1985**

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Video-Out Projection and Lecture Hall Set-Up

Drexel's decision to use the Apple Macintosh in its Microcomputer Program created a few challenges for our technicians. We were faced with finding a way of displaying the Mac's screen to large groups of people. At Drexel, Macs are used in classrooms of about 25 people, and in lecture halls of about 250. Standard video monitors and video projection systems were not suitable for this task because the Macintosh does not have a standard NTSC video output. Standard video signals have a horizontal sweep frequency of about 15.7 KHZ, while the Macintosh has a sweep frequency of 22.355 KHZ. Our problem was to find either a projection system or monitor which could accept this non-standard signal.

To project the Mac screen to large groups of students in lecture halls, we chose the Electrohome EDP-57 video projector. The EDP-57 can accept a horizontal sweep frequency of between 11 and 24 KHZ which is perfect for our application. It can also be used for rear projection, and on a flat screen. If a flat screen is used, we recommend that you tilt the top portion of the screen down 10 degrees to avoid keystoneing. The EDP-57 is continuously focusable from 4-foot diagonal to 10-foot diagonal. Throw distance is about 1.5 times the diagonal screen size, so if you want a diagonal screen size of 8 feet, your projector will be 12 feet from the screen.

For a few weeks we used the projectors as portable units, delivering them all over the campus. To do this we bought wheeled floor stands which are available with the projector. Eventually, high security cabinets were designed and built to house the projectors permanently in lecture halls. One cabinet houses the projector itself and is floor mounted so that we can have easy access to the focusing and horizontal controls on the rear of the projector. The turn of a key activates a scissor and platform mechanism which raises the projector from the cabinet and turns it on.

As long as the projector is not moved, all focusing and keystone adjustments can be pre-set. There may be a time when you want to adjust the horizontal frequency control, as would be the case if you switched from one kind of computer to another. You may also wish to have easy access to brightness and contrast controls, which are mounted on the rear of the projector too. Keep this in mind when deciding where to mount your projector. A ceiling mount design may not work for you, especially if your ceilings are very high. Mounting the projector at too steep an angle would result in bad keystoneing.

A second box containing the Macintosh is located 10 feet away. This second box or "instructor's stand" is connected via an umbilical cord to the projector cabinet. The umbilical cord contains the video output cable, and a few power lines.

This system was put together quickly, in an effort to meet the immediate needs of the University. The system works, but it should not be used with such large groups. The larger you project the picture, the dimmer the picture gets. For this reason we must keep the lecture hall fairly dark. In addition, a 10-foot diagonal screen is not always adequate for viewers in the last row. Using large-size text and highlighting text help to make images easier to read. If this system were being designed again, I would recommend that the projectors be used with group sizes which do not exceed 75 people. I also would recommend that font size be not less than 24 pt. For groups of 75-250 people, I suggest that other projectors be explored.

For a classroom of about 25 people we found a great way to display the Macintosh screen. We purchased Electrohome EVM2319 black-and-white monitors which were modified at the factory to accept 22.355 KHZ. This modification is a standard procedure for this model and is mentioned in the instruction and service manual. These monitors cost about \$850.00 each, and have 23" screens. The picture these monitors produce is outstanding. We are very impressed with their excellent resolution and picture quality. Currently, we are delivering units all over campus which

consist of an Electrohome monitor and a Mac, mounted on a wheeled cart. Plans have also been made for a computer classroom which is equipped with two Electrohome monitors. Enclosed are the performance data and specifications for both the Electrohome projector and monitor. Newer versions of the EDP-57 may be available that I am not aware of at present.

PERFORMANCE DATA AND SPECIFICATION

PROJECTOR

1. OPERATING AND SERVICE CONTROLS

Rear External

Optical focussing of projection lens
Power on-off switch
Brightness control
Contrast control
Video input 75 ohm termination switch
AC power input

Rear Internal (screwdriver)

Electrical focus
Keystone correction
Vertical size (height)
Vertical hold
Horizontal size (width)
Horizontal hold
Primary fuse (1.5A slow blow std.)
Reversed Scan Switch for rear screen projection

Internal (top cover removed)

120/220/240 VAC plug connection
(120 VAC std.)
Vertical linearity adjust
Horizontal video centering adjust
D.C. restoration switch
back porch clamp (STD)
sync tip clamp
G2 bias supply adjust

2. VIDEO CIRCUITS

Input

2 BNC connectors (looped through)
75 ohm $\pm 1\%$ terminated
25K ohm shunted by 12pf open
input level 0.5 to 2.0 volts p-p sync negative
differential (floating) input rejects 14 volts
p-p of power line hum voltage

Frequency Response

20MHz bandwidth ± 3 db

D.C. Restoration

Back porch keyed clamp internally switchable to sync tip clamp.

Gain

Min. video gain 40 dB or 100X
Max. video output 110V p-p drive.

3. DEFLECTION CIRCUITS

Vertical Deflection

Size: adjustable from 50% overscan to 20% underscan.
Frequency range: from 45Hz to 80Hz
Retrace time less than 0.5 milliseconds

Horizontal Deflection

Size: adjustable from 20% overscan to 10% underscan.
Frequency range: 11Kz to 24Kz
Retrace time: less than 6 microseconds

4. HIGH VOLTAGE

32.0 Kv regulated to better than $\pm 1\%$

5. BRIGHTNESS

100 foot-lamberts peak on axis on a 1.5 m (5 ft.) diagonal 10 gain screen.
100 lumens total light output. (Std. P1 Phosphor)

6. DISPLAY

Green P1 Phosphor Standard. Optional phosphors available on special order.
Throw distance approx. 1.2 x screen diag. size.
Continuously focusable from 1.2 m (4 ft.) diagonal projected picture to 3.1 m (10 ft.) diagonal.
Aspect ratio 3:4
Keystone circuitry to correct picture for projection angles up to $\pm 15^\circ$ vertically from screen axis.

7. POWER REQUIREMENTS

120 VAC $\pm 10\%$ can be internally reconnected for 220 VAC $\pm 10\%$ or 240 VAC $\pm 10\%$.
Line Frequency 50 or 60 Hz nominal.
Power 120 watts max.

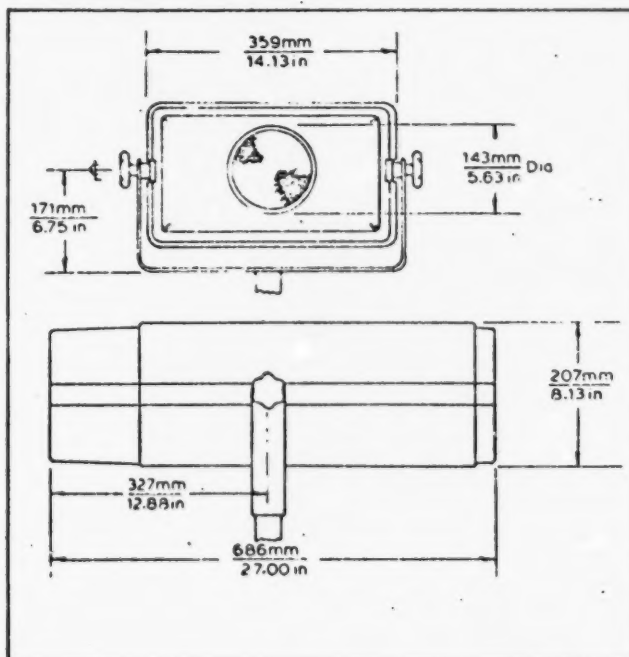
8. ENVIRONMENT

Maximum Operating Range

Temperature: 0° to 35° C
Humidity: 0 — 90% non condensing
Altitude: 0 — 3,000 m (0 - 10,000 ft.)

Storage

Temperature: -30° C to 65° C



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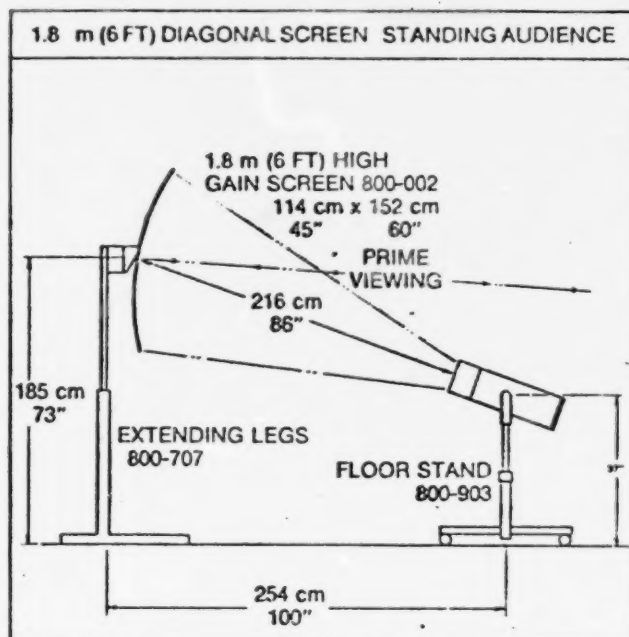
INTRODUCTION

The EDP-57 is a high performance, extremely versatile projection monitor designed to produce a stable high resolution projected display on a wide variety of screens. It is unique in that it will synchronize with almost all CRT type computer terminals available today. If the terminal has a composite video output jack as is the trend, a length of coaxial cable is all that is required to interface the projector. The result will be a large, bright reproduction of what is being displayed on the terminal's small CRT display. If your terminal has no output, a small interface module available separately will be required to generate the composite video signal from timing and

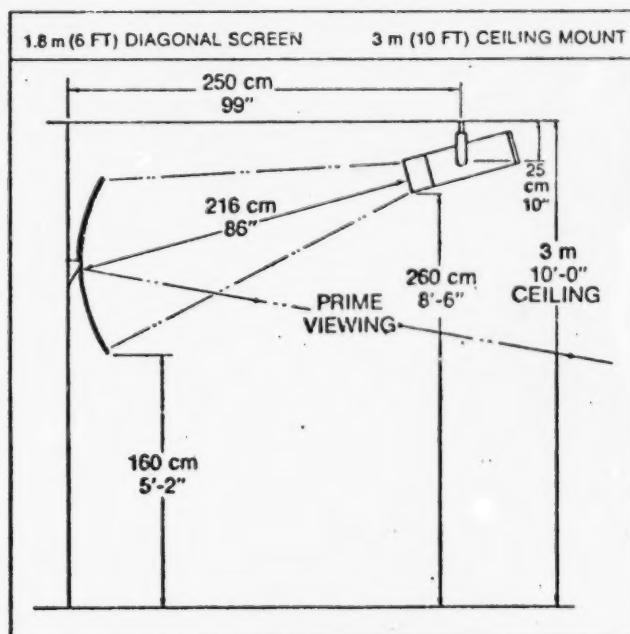
video signals now driving the internal display. Please see your dealer, distributor or salesman concerning this interface module.

Since the chassis is designed for composite video in all existing broadcast standards as well as many non-standard frequencies, it will display video in monochrome from all standard video tape recorder and video disk outputs in both North American and European standards. However, it was primarily designed for data displays, both alphanumeric and graphics. As such it must operate at many non-standard line rates and frame rates.

SPACE REQUIREMENTS



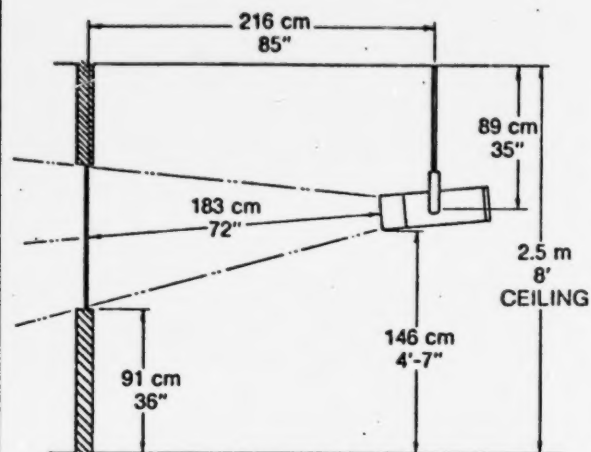
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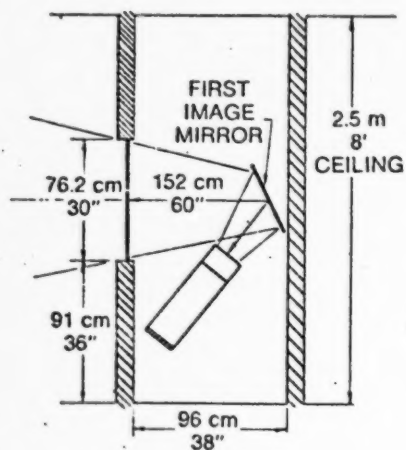
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1.5 m (5 FT) DIAGONAL SCREEN REAR PROJECTION



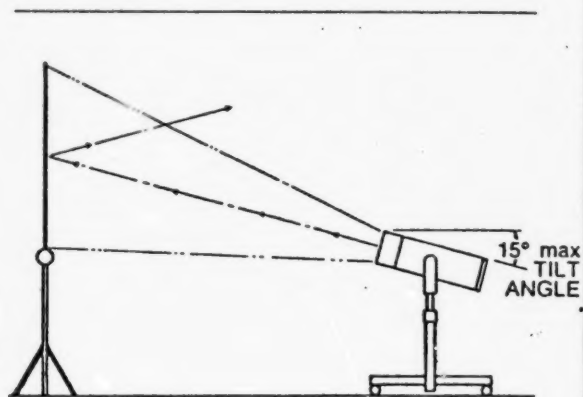
NOTE: SLIGHT DOWNWARD TILT IS FOR SIMPLE REAR SCREENS MOUNTED HIGHER THAN EYE LEVEL... TO REDUCE OFF CENTER HOT SPOTTING.

127 cm (50") DIAGONAL SCREEN REAR PROJECTION

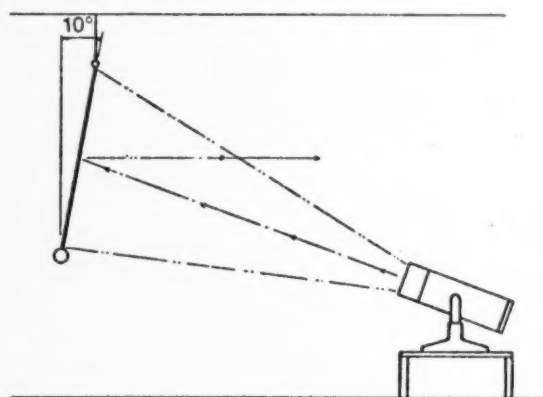


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FLAT SCREEN VERTICAL MOUNT GOOD



FLAT SCREEN 10° TILTED MOUNT BETTER



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MONITOR

PERFORMANCE DATA and SPECIFICATIONS

FEATURES

Front Panel Controls

On-off Switch
LED Pilot Light
Reduced Scan Switch
VTR Switch
Horizontal Hold
Focus (screw driver adjust)
Vertical Hold
Height (screw driver adjust)
Brightness
Contrast
A-B Switch
Volume Control (only with optional audio module)

Internal Controls

Preset Contrast Control
Preset Brightness Control
Black Level Control
Vertical Linearity Control
Horizontal Frequency Centering
Horizontal Phase Control
(Video Centering)
AC-DC Coupling Link
(factory set in DC position)
Voltage Regulator Control
Size Regulation Control
Reduced Scan Width Coil

Rear Panel

Input A - 2BNC connectors, loop-through
Input B or Ext. Sync - 2BNC connectors, loop-through
2 Termination Switches
Ext. - Int. Sync Switch
AC Connector
Fuse Holder
Width Control

Electrical Specifications

Input Signal: 0.5V to 2V p-p, sync negative
Band Width: 100Hz - 18MHz ± 3 db at 30V p-p at CRT cathode
Resolution: 15", 17" and 23" CRTs:
(P4 Phosphor, 1000 TV lines center
Polished Face Plate) 800 TV lines corners at 30ft/l (300 lux)
Standard 9" CRTs:
700 TV lines center
550 TV lines corners at 30ft/l (300 lux)
Standard 12" CRTs and Optional 9" CRTs:
800 TV lines center
650 TV lines corners at 30ft/l (300 lux)
Rise & Fall Times: ≤ 20 nsec.
Field Square Wave
Tilt: $\leq 5\%$
Line Square Wave
Tilt: $\leq 5\%$
Hor. Retrace Time: 7.5μ sec.
Vert. Retrace Time: 650μ sec.
Differential Gain: 5%

Black Level Stability: $\leq 2\%$ 10% to 90% APL 20ft/l
Common Mode
Rejection: 40db up to 6V p-p
Picture Size Stability: $\leq 2\%$ change 0-30ft/l
Geometry: $\leq 2\%$ of height
Linearity: $\leq 2\%$ of height
Hor. Pull In: ± 300 Hz
Interlace: 45:55
Power Supply: 120/220/240V selectable by internal plug, 50/60Hz
Line Regulation: Scan size changes less than 1% from 100V-132V (200-264V) by use of internal line selector plug.
Horizontal Scan Rates: 15.750KHz to 18KHz standard; 18KHz to 22.5KHz optional
Operating Range: 0° to +50°C
0 to 10,000 ft
To 90% relative humidity non-condensing
Storage: -40°C to +65°C

WARNING

TO PREVENT FIRE OR SHOCK HAZARD DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE